

2019

STEM ENGAGEMENT HIGHLIGHTS

Johnson Space Center
External Relations Office



INSPIRE - ENGAGE - EDUCATE - EMPLOY

The Next Generation of Explorers

NASA's Johnson Space Center (JSC) has served as the iconic setting to some of humankind's greatest achievements. For nearly 60 years, as part of NASA's nationwide team, we have led the world in human space exploration.

For **Johnson's Office of STEM Engagement (JOSTEM)**, 2019 was no different as we celebrated anniversaries and looked forward to our next giant leap. As we bring the world along with us on our missions, we are poised to inspire a new generation of explorers to reach to greater heights.

The Agency's Artemis program will land the first woman and next man on the Moon by 2024 and pave the way to Mars. Just as this mission aims to collaborate with our commercial and international partners to establish sustainable exploration, JOSTEM is also laser-focused on increasing knowledge among stakeholders and raising awareness outside of traditional audiences.

"As a nation, we still have a lot of work to do to get more students — particularly women and minorities — in the STEM pipeline," said JSC External Relations Office Director Deborah A. Conder. "We need to continually develop the next generation of STEM students and instill in them the skillset to help us take the next steps from the Moon and on to Mars."



Just like Artemis crewmembers, students and educators are JOSTEM's explorers, and even in our roles here on Earth, we as an Agency are all rallied around the same goal:

All that we build, all that we study, all that we do, prepares us to go.

Overall, 2019 yielded powerful work in attracting students and engaging the Artemis Generation. NASA is making valuable contributions to our nation's STEM ecosystem by creating mission-driven opportunities for students to contribute to NASA's work, helping to build a vibrant and diverse next-generation STEM



workforce, and leveraging unique opportunities toward enhancing STEM literacy.

Under the direction of NASA's Office of STEM Engagement this year, JOSTEM alone engaged thousands of students and educators through student work experiences, student learning experiences, research and development, education and institutional support and strategic partnerships. Our activities and initiatives attract participants from across the nation, but there is a keen focus on the Texas community in particular. With an eye toward maintaining Houston's legacy as Space City, programs such as Texas Aerospace Scholars inspire Texas students to explore careers in STEM fields that are key to future NASA missions. Likewise, partnerships such as our work with Houston Independent School District's U. S. Department of Education Magnet School Assistance Program provide instructional coaching enriched with NASA content to Texas educators.

You are invited to explore the impact of JSC's STEM engagement efforts in the pages that follow.



2019 BY THE NUMBERS



27K+

educators were engaged through hands-on workshops, downlink events and webcasts



160,000+

students were engaged through hands-on activities, downlink events and webcasts



582 million

people were reached through social media platforms such as Facebook, Twitter and Instagram

VISION

We immerse students in NASA's work, enhance STEM literacy and inspire the next generation to explore.

MISSION

We engage students in NASA's mission.

FOCUS AREAS

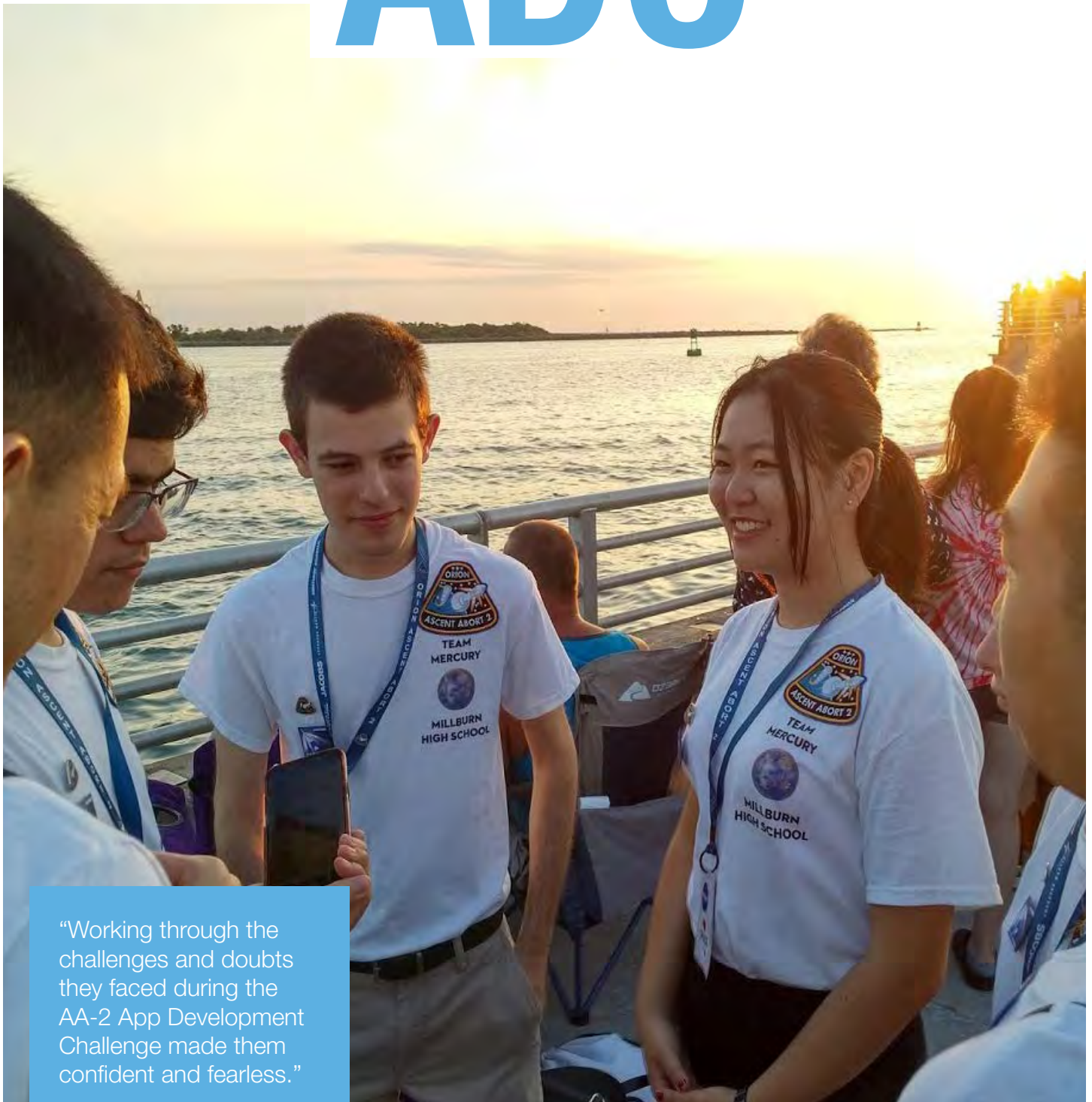
1
Create unique opportunities for students and the public to contribute to NASA's work in exploration and discovery.

2
Build a diverse future STEM workforce by engaging students in authentic learning experiences with NASA's people, content and facilities.

3
Strengthen public understanding by enabling powerful connections to NASA's mission and work.

APP DEVELOPMENT CHALLENGE

ADC



“Working through the challenges and doubts they faced during the AA-2 App Development Challenge made them confident and fearless.”

– ADC lead teacher

www.nasa.gov/education/appchallenge

NASA's App Development Challenge (ADC) is a coding challenge where NASA presents problems to middle and high school students seeking student contributions to the deep space exploration missions. By responding to the App Development Challenge, students take a part directly in the Artemis generation's endeavors to land American astronauts, including the first woman and the next man, on the Moon by 2024. In this ADC, students worked in teams to develop an app that visualized three minutes of simulated test data in support of the Ascent Abort-2 (AA-2) flight test. Teams with favorable submissions advanced to present their app in an interview with NASA engineers working on AA-2. After this round, NASA selected two student teams for an all-expenses paid trip to Kennedy Space Center to attend the AA-2 flight test, participate in various STEM activities and present their app solution to NASA leadership.



2019 TRIUMPHS



723

Students and 125 educators reached through NASA's App Development Challenge

200+

Students and 30 educators participated in the live virtual connections with NASA subject matter experts

22

Schools representing 13 states participated in the challenge

2

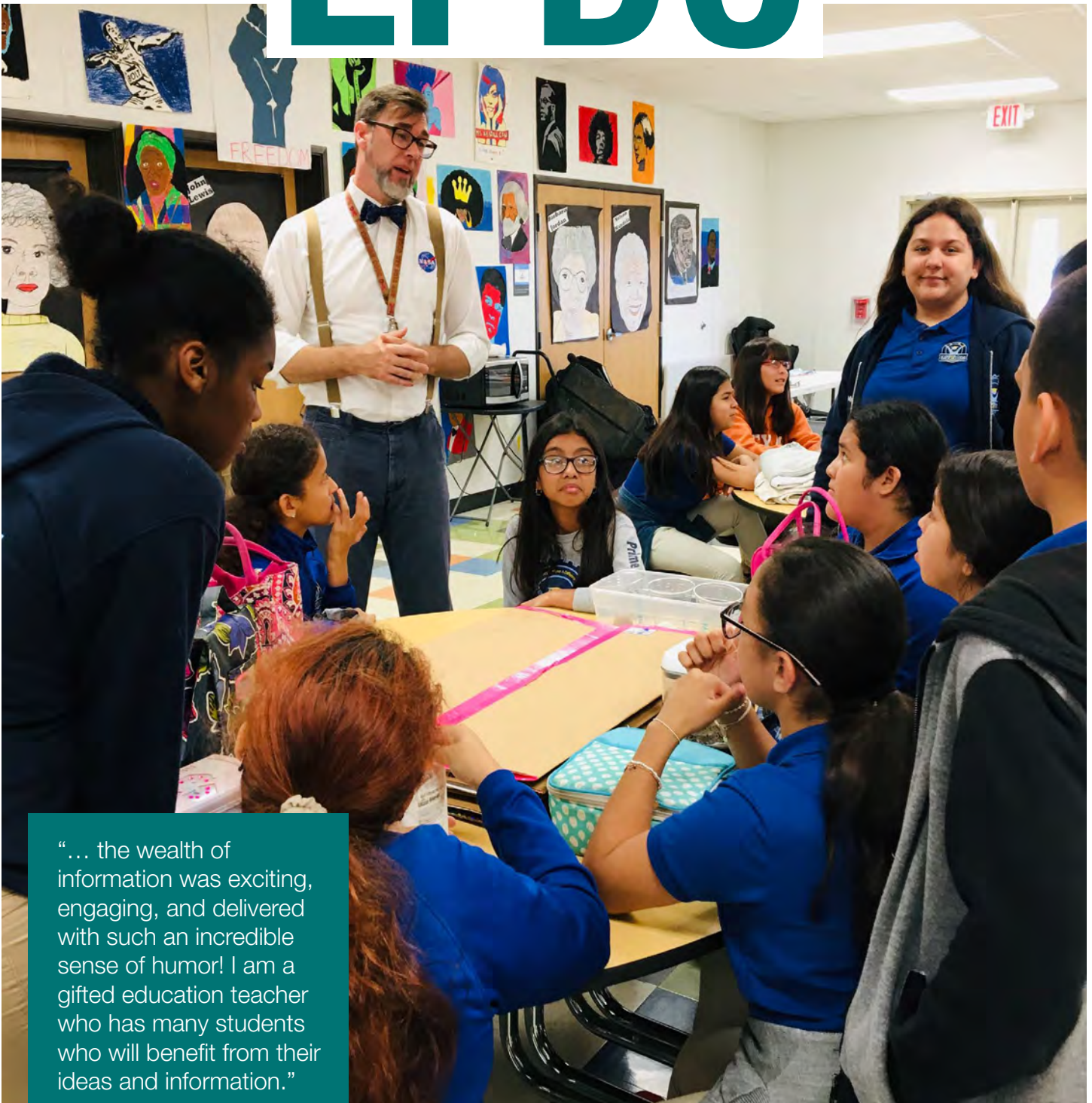
Teams selected to attend the culminating event where they attended the AA-2 launch live at Kennedy Space Center

ON THE HORIZON

NASA's next App Development Challenge is being developed and will be available soon. Check our website for updates and more information: www.nasa.gov/education/appchallenge.

EDUCATOR PROFESSIONAL
DEVELOPMENT COLLABORATIVE

EPDC



“... the wealth of information was exciting, engaging, and delivered with such an incredible sense of humor! I am a gifted education teacher who has many students who will benefit from their ideas and information.”

– EPDC participant

<https://www.txstate-epdc.net/>

NASA STEM EPDC is committed to conducting educational research and providing high-quality STEM professional developments to educators. Through real-time and self-directed options in face-to-face and online training platforms, educators gain professional growth from options that included digital badges, aerospace-themed webinars, keynote addresses on STEM education pedagogy and hands-on workshops.



2019 TRIUMPHS



6,500

Educators reached through face-to-face events and an additional 1,000 educators reached through virtual events

65

Events were supported by JSC's EPDC specialist

300

Students participated in hour long hands-on STEM engagement activities at the Navajo Technical University event

IMPROVEMENTS

EPDC expanded to include student-centered STEM engagement experiences. This new endeavor had engaged nearly 1,000 students by the 4th quarter of 2019.

HIGH SCHOOL AEROSPACE SCHOLARS

HAS



"Now that I went through HAS, I will continue to pay closer attention to chemistry and math to get a better idea of how these subjects relate to the real world."

– HAS participant

www.nasa.gov/has

Since 1999, the High School Aerospace Scholars program has been 100% funded by the State of Texas, the University of Houston, the Houston Livestock Show and Rodeo, and the Rotary National Award for Space Achievement to provide Texas high school juniors an opportunity to explore a future in STEM. In 2019, 778 students joined the NASA team through an 16 week on-line program focused on space exploration, the Earth, science, technology, mathematics and aeronautics. Summer 2019, 264 students were invited to Johnson, to unite with like-minded students to plan a mission to Mars. Seventeen HAS alumni now working at NASA as scientists and engineers mentored the students.



20 YEARS AT A GLANCE



\$11.85M

Invested by funding partners

4800

Students have completed the onsite program

2000

NASA employees have mentored students

400

Certified Texas educators have participated in the program

DID YOU KNOW?

HAS partners with the State of Texas, the University of Houston, the Houston Rodeo, and Rotary National Award for Space Achievement, and they collectively contributed \$11.8M to support Texas student and teacher participation in HAS.

HAS has participants from Houston Independent School District, the largest public school system in Texas and the 7th largest in the Nation.

JOHNSON SPACE CENTER

INTERNS



"Getting the opportunity to intern at both Langley Research Center and Johnson Space Center has been beneficial to honing my skills as a data scientist. I got to develop machine learning algorithms with data, literally, out of this world!"

– Intern

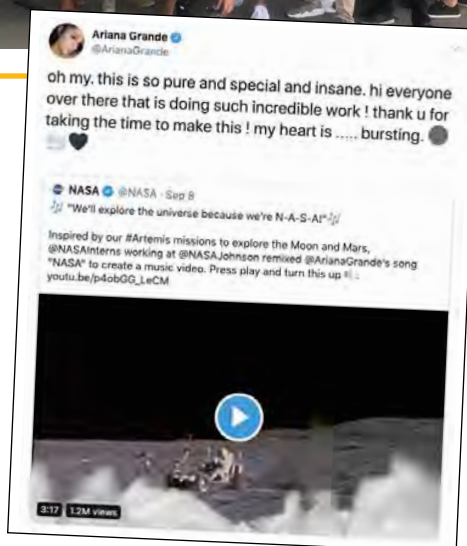
intern.nasa.gov

NASA Internships at Johnson Space Center and White Sands Test Facility contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals through a portfolio of investments. Our Internships Program Coordinators collaborate with mentors across the center to provide meaningful educational experiences for students. Students are benefiting mentors by advancing their mission-focused individual projects and NASA's overall mission. Internships create engaging educational opportunities for students to contribute directly to NASA's mission while providing a strong pathway to a career with NASA and/or the STEM workforce.



JSC Interns Go Viral

In an effort to promote NASA's upcoming mission of sending the first woman to the moon, JSC interns remixed Ariana Grande's "NASA" song rewriting the lyrics to highlight NASA's mission. The video received over 1.6 million views (and climbing) on social media. Over 1,000 news articles highlighted the video.



2019 TRIUMPHS

233

Students were placed by Johnson's Office of Stem Engagement

115

Colleges or universities from 36 states across the country (plus D.C. and Puerto Rico) represented by the 233 Interns at JSC

60%

Of the interns were placed in underrepresented STEM fields

36%

Of the students identified as female

24%

Of the student identified as Hispanic or Latino

MICROGRAVITY NEUTRAL BUOYANCY
EXPERIMENT DESIGN TEAMS

MgNExT



"The highlight was to be able to test our design after two semesters of preparation. We learned how to work with a team and create a design that can be fabricated on schedule..."

– MgNExT participant

<https://go.nasa.gov/mgnext>

Micro-g NExT is a mission-driven authentic NASA STEM experience. This Human Exploration Operations Mission Directorate (HEOMD) collaboration with Office of STEM Engagement integrates undergraduate students into the technology and hardware development paths of NASA missions in support of human space exploration. The overall experience includes hands-on engineering design, test operations and public outreach. Student teams travel to the NASA's Johnson Space Center to test their tools in the simulated microgravity environment of the Neutral Buoyancy Laboratory (NBL) — a 6.2 million gallon pool used for astronaut training.



FUN FACTS

Former Micro-g NExT participants are now NASA flight controllers, robotics engineers, and space suit engineers.

Micro-g NExT student designed tools were tested by Astronauts Victor Glover and Mike Hopkins in the 6.2 million gallon pool used for astronaut training.

ON THE HORIZON

2020 Micro-g NExT student teams will develop Artemis mission enabling solutions for collection of lunar samples and emergency measures for Orion crewmembers.



2019 TRIUMPHS



The EVA zip tie cutter is the first Micro-g NExT student designed technology used in spacewalks aboard the International Space Station



119

Innovation space exploration solutions produced by undergraduate student teams

55

Institutions representing 29 states including 15 Minority Serving Institutions and nine community colleges

MUREP INNOVATION AND TECH TRANSFER
IDEA COMPETITION

MITTIC



"I feel like this experience has defined a period of my life. My future goals have more shape and I believe I CAN work at NASA."

– MITTIC participant

<https://go.nasa.gov/NASAMITTIC>

MUREP Innovation and Tech Transfer Idea Competition (MITTIC) is a higher education spinoff challenge established to develop new ideas for commercialization by seeking concept papers from multi-disciplinary student teams enrolled at a Minority Serving Institution (MSI).



2019 TRIUMPHS



70

Students and faculty from 10 MSIs in seven states and one U.S. territory participated in MITTIC

44

Historically Black Colleges and Universities scholars in Washington, DC participated in mini-MITTIC competition

41%

Of participants are female

9

NASA Internships at Ames funded by MITTIC

ON THE HORIZON

Used intellectual properties (IP) enhancing contributions to Artemis missions.

Designed a concept paper portal allowing Institutions to submit more than one concept paper. Submission of a MITTIC concept paper is now a requirement in entrepreneurship classes.

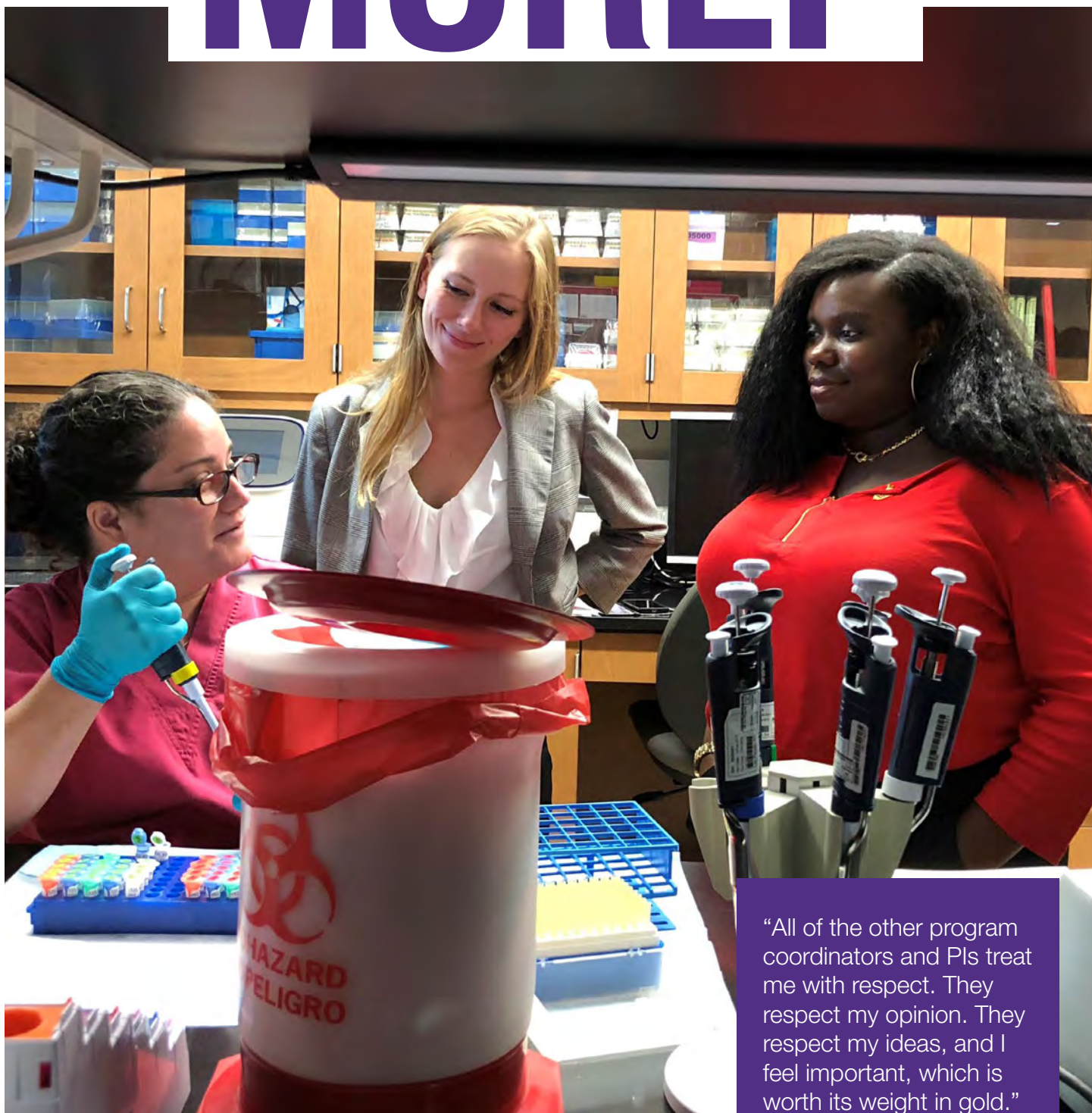
Created a "Concept to Commercialization" curriculum standardizing faculty and student learning process.

Expanded internal and external internships from nine to 30 students per MITTIC session to contributing to a diverse STEM workforce.

Additional NASA Center's participating in MITTIC increased internal partnerships; additional participation of small business commercialization subject matter experts increased external partnerships.

MINORITY UNIVERSITY RESEARCH
AND EDUCATION PROJECT

MUREP



"All of the other program coordinators and PIs treat me with respect. They respect my opinion. They respect my ideas, and I feel important, which is worth its weight in gold."

– MUREP participant

www.nasa.gov/education/murep



MIRO

MUREP Institutional Research Opportunity

MUREP Institutional Research Opportunity (MIRO) aims to strengthen and develop the research capacity of Minority Serving Institutions (MSI) in areas of value to NASA's mission. NASA invites MSIs across the nation to submit research proposals based on current NASA needs. Selected institutions receive funding, support from NASA subject matter experts and the opportunity for student internships at a NASA center.

889

Students enrolled in Undergraduate and Graduate level courses as a result of the relevant coursework offered by MIRO

2,000

Students provided with significant, direct student awards in higher education

2,375

Students and educators impacted through MOO awardee outreach events



MOO

MUREP Other Opportunities

MUREP Other Opportunities (MOO) awarded six MSIs with NASA funding and support to innovatively create and implement STEM opportunities designed to attract, retain and support the success of underrepresented students, including women and girls and persons with disabilities into STEM fields. Awards assist faculty and students in research and provide authentic STEM engagement related to NASA missions.

MUREP for American Indian and Alaska Native STEM Engagement

MAIANSE



The long-range goal of MUREP for American Indian and Alaska Native STEM Engagement (MAIANSE) is to increase the number of Native American students who pursue careers in IT and STEM disciplines. The short-term goal is to document improvement in IT skills and STEM understanding of the students who are participating. A key element is creating a curriculum for predominantly Native-American-serving high schools.

50%

Increase in Southwest Indian Polytechnic Institute engineering program enrollment for Fall 2019 with the addition of 25 more students

NASA COMMUNITY COLLEGE AEROSPACE SCHOLARS

NCAS



"The fact that NCAS specifically serves community colleges students appealed to me, because it made me feel like we (meaning community college students) mattered."

– NCAS participant

<https://go.nasa.gov/ncas>

NASA Community College Aerospace Scholars (NCAS) is an educational experience for community college students interested in exploring careers in STEM. Students participate in a five-week online learning experience consisting of discussions, webinars with NASA subject matter experts and design challenges about future missions to the Moon and Mars. Select students attend a four-day engineering design challenge at a NASA Center.



2019 TRIUMPHS

1,360

Students participated in the online community representing a 10% increase from the prior year

891

Students participated in 20 experiences at 10 NASA centers and facilities



Alumni

from Des Moines Area Community College made NCAS history when their microalgae research launched on an ISS payload

ENHANCEMENTS

Re-structured NCAS staffing to include a communications specialist, creative specialist, curriculum design specialist, and instructional designer.

Launched, "NASA on Campus" pilot expanding NCAS to six community college Space Grant affiliates.

ON THE HORIZON

Up to 10 new community colleges will receive awards through a MUREP-Space Grant Partnership to bring NCAS to more locations across the country.



NASA SPACESUIT USER INTERFACE
TECHNOLOGIES FOR STUDENTS

SUITS



"This past week was an amazing experience and definitive turning point in many of our design careers. We returned to Harvard's Graduate School of Design today ready to inspire others to contribute to space exploration technology."

– SUITS participants

<https://go.nasa.gov/NASASUITS>

The NASA Spacesuit User Interface Technologies for Students (SUITS) Design Challenge creates unique opportunities for students to contribute to NASA's future EVA missions for Artemis. NASA SUITS is a Science, Technology, Engineering, and Mathematics (STEM) Engagement design challenge where undergraduate and graduate student teams code and create user interface concepts for spacesuits that enable increased human-autonomy, which is necessary to meet the elevated demands of lunar surface exploration and extreme terrestrial access. Selected teams travel to NASA's Johnson Space Center to test and evaluate prototypes during an onsite immersive experience while working with engineers and scientists using NASA's unique facilities and assets.



2019 TRIUMPHS

2 Million

Individuals reached both directly and indirectly from FY19 SUITS participants and through social media

17

Institutions were represented by 2019 SUITS teams — an increase of more than 70% when compared to 2018

12

Papers and conference proceedings were published by students and faculty advisors

24

NASA volunteers from eight organizations served as design evaluators

ADVANCEMENTS

SUITS is a full participation activity. Teams not selected for the onsite design review were invited to participate virtually. Virtual participants shared their ideas and final design concepts with the SUITS community, presented to NASA experts, and participated in live streamed events.

ON THE HORIZON

Upcoming implementations include using a more feasible tool to share code while providing real time updates through GITHUB and using Slack to communicate with prospective teams about upcoming due dates and questions regarding the challenge.

STEM ON STATION

SoS



"These kids really took away that what they're learning is relevant and is real and if they dream big enough they can do anything. They can make their dreams come true with hard work and study."

– Teacher

<https://www.nasa.gov/stemonstation>

STEM on Station uses the International Space Station, its crew, and onboard research to advance NASA and the nation's STEM education and workforce pipeline. STEM on Station inspires, engages, and educates students and educators using NASA-unique resources and opportunities such as live conversations with astronauts in space, hands-on STEM activities developed through high-profile partnerships, and videos filmed by astronauts in space showcasing STEM concepts.



2019 TRIUMPHS

48,000

Average views
for the STEM on
Station website

73,000

Students and
4,200 educators
reached by 19
in-flight Education
Downlinks between
astronauts aboard
the International
Space Station and
students in 15 states
including the District
of Columbia



ON THE HORIZON

Celebration of the 20th anniversary of continuous human presence aboard the International Space Station which includes the release of new opportunities and resources for students and educators.

New opportunities and resources tied to Commercial Crew launches.



235,000

Views of the
STEMonstrations
video library

8

Space station
themed STEM
lesson plans created
in partnership with
Microsoft Education

WEARABLE EQUIPMENT FOR AVERTING RADIATION

WEAR

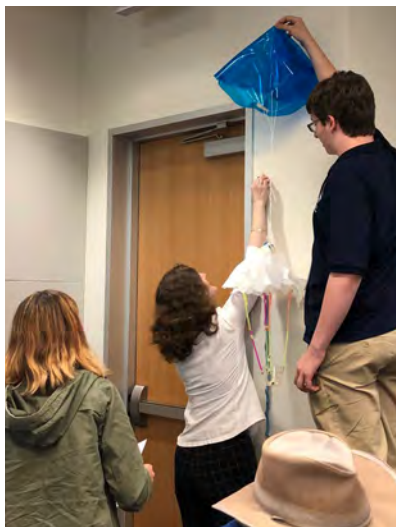


“This is showing them what the real application of the work they’re doing is — this is not a fictitious or fabricated scenario. I’m hoping this is going to continue to fuel their passion for what they’re doing.”

– Educator

https://go.nasa.gov/nasa_wear

The WEAR STEM Challenge (WEAR) focuses on wearable technologies. Students create designs to protect deep space astronauts from harmful radiation. WEAR provides authentic learning to teams of middle and high school students who use engineering to answer real problems presented by real NASA engineers and scientists. Students are provided an ultimate experience to contribute to NASA's deep space exploration mission.



2019 TRIUMPHS



1,457

Students reached through the inaugural WEAR challenge

218

Educators reached through the inaugural WEAR challenge

17

Teams from 11 states including Puerto Rico submitted design proposals

10

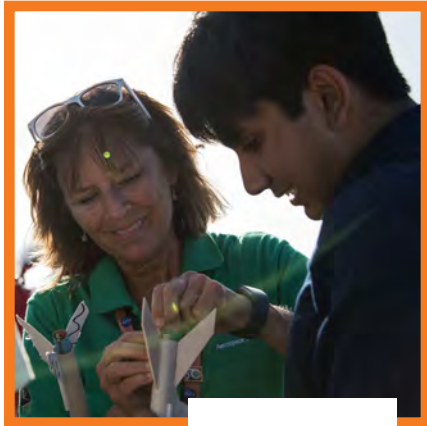
Teams (five middle school and 5 high school) were selected for an onsite visit to NASA's Langley Research Center

FUN FACTS

The Johnson Space Center Office of STEM Engagement collaborated with NASA's RadWorks Project to develop and present the WEAR challenge. (Radworks is a NASA research project focused on detection, monitoring and protection from harmful during exploration beyond low Earth orbit.)

During the design phase of the challenge, teams worked to develop designs while participating in webinars to help them understand the radiation environment or deep space and the effects on crew members.

The WEAR challenge helped the RadWorks Project collect new ideas for protecting crew members as we go forward to the Moon and on to Mars.



Office of STEM Engagement
uses NASA's unique
capabilities to advance
STEM education and human
space exploration.



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